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MANITOBA WATER SERVICES BOARD EVALUATES THM REMOVAL TECHNOLOGY

By **Nick Pecoskie**

Recently, the Manitoba Water Services Board (MWSB) set out to overcome the problem of undesirable disinfection byproducts (DBPs) in the drinking water of rural Manitobans.

The MWSB, established in 1972 as a Crown Corporation under the *Manitoba Water Services Board Act,* has a mandate to assist with providing drinking water and sewage services to rural Manitobans. Manitoba has a population of 1,300,000, with roughly 725,000 living in the City of Winnipeg and the Greater Winnipeg Area. This means over 55% of the population inhabits rural, often remote locations, presenting MWSB with a vast geographic infrastructure challenge.

As with other rural communities across Canada, MWSB customers often contend with water that may be "high in age" by the time it arrives at the local community, after traveling via long distance transmission lines.

Disinfection byproducts form over time and with increasing frequency as water temperature rises. In Manitoba, the factors creating the conditions for DBP formation in drinking water are both inherent and perennial. Drinking water is sourced from some of Manitoba's and Canada's most storied rivers and lakes, including the Assiniboine River. Raw water is treated centrally and then pumped throughout a network of transmission pipelines to rural distribution systems.

The same chlorine that is used to disinfect the drinking water in order to reduce or eliminate microorganisms also reacts with any organic matter naturally present to produce DBPs. The most common of these DBPs are trihalomethanes (THMs). These are regulated across Canada to a level of 100 ppb (parts-per-billion) annual average and, as such, both proactive and reactive solutions are employed to limit and remove THMs and keep the water within regulations.

The time it takes water to travel from the water treatment plant to the end user is referred to as "water age." Because it is a driver of DBP formation, water age is monitored closely by utility operators. It is this combination of long transmission lines and the inevitable biological material that, when combined with chlorine, serve as a precursor for THM formation, that the MWSB set out to remedy.

In 2016, key staff at MWSB, including Tyler Foxton, a project engineer, identified a specific location in the rural community of Plumas as requiring further analysis and action to counter DBP formation. As far back as 2014, MWSB observed steadily increasing THM levels of over 200 ppb and began testing removal of soluble organic material, one of the THM precursors, as a potential solution. As a result of the testing, the Board concluded that detention time in the reservoir combined with the inherent water age resulting from a 96 km pipeline would continue to foster THM formation even after removal of organic matter.

Foxton identified a paper published in the *AWWA Journal* by Ethan Brooke, describing his work on DBP removal via aeration while at the University of New Hampshire.

After careful consideration of possible treatment options, the MWSB issued a request for pricing (RFP) for a technical trial pilot project to assess whether available technologies could mitigate THM formation in the 373,000-litre Plumas, Manitoba drinking water storage reservoir.

The trial project enabled the Board to gather THM data over an extended period of time. This provided a comprehensive view of the effectiveness of the proposed technical solution prior to making any long-term decisions or substantial capital investments.

PSI Water Technologies, Inc. (PSI) and PAX Water Technologies, Inc. (PAX), both subsidiaries of California-based UGSI Solutions, Inc., were selected to perform the one-year pilot test to strip THMs from

the Plumas tank. The companies demonstrated significant practical experience in utilizing water storage assets, like the Plumas reservoir, as an intervention point to eliminate THMs in distribution systems.

This unique approach of using the water storage tanks as treatment technology assets is a departure from traditional thinking around drinking water distribution systems. Essentially, the PAX TRS™ system uses the water reservoir as a reaction vessel to enhance volatilization of THM compounds from the liquid phase (water) into the gas phase (headspace of the tank) and then remove them from the tank. The PAX TRS system, which includes submerged mechanical tank mixers, rooftop ventilation units and surface aerators, integrates seamlessly to release THMs from the tank water into the headspace and then out of the tank.

By utilizing Henry's Law and various mass transfer principles embedded in the proprietary PAX Neptune™ equipment selection software, the engineering team at PAX and PSI was able to predict the level of THM removal and optimize energy usage to save operating costs. This meant MWSB obtained the appropriate amount of capital equipment required to achieve the desired THM removal rates, without having to pay more in operating costs for oversized equipment.

The team factored in the sub-zero temperatures during the Manitoba winter and added an air heater to the Powervent® ventilation unit to ensure that frigid air was not blowing into the tank during the winter, creating unwanted icing issues. Installation and commissioning took only three days, and the PAX TRS system has been delivering the promised results since start up. Installation validation data shows that the system is delivering a 69% reduction in THMs. ■

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